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Full Length Research Paper

A comparative analysis of the growth performance of okra (*abelmoschus, esculentus (l.) Moench*. In different soil media

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Field studies were carried out to compare growth characteristics of Okra seedlings in two different sol media. The soil media were untreated soil (control) and lime treated soil. Data was collected on parameters such as germination time, plant height, leaf area, number of leaves and fruiting emergence. Data on germination time was obtained at days after planting while, those on plant height, leaf area, number of leaves and fruiting emergence was obtained at 2, 4, 6, 8, 10 and 12 weeks after transplanting. The results showed that there were significant differences (P<0.05) between plant heights, of Okra seedlings in the two different soils while there were no significant differences in leaf area, number of leaves and fruit emergence of Okra seedlings grown in the untreated soil and lime treated soil. The seedlings grown in lime treated soils had the earliest germination time,(2 days,) highest plant height (25.45cm) number of leaves (9,) fruit emergence (7) and leaf area (20.90cm) compared to seedlings grown untreated soil which had an average plant height of (14.36cm), number of leaves (7), fruit emergence (5) and leaf area (18.44cm). It is therefore recommended that soil treated with lime which exhibited a better growth performance should be adopted in cultivating okra.

Keywords: Analysis, Comparative, Growth, Okra, Soil.

INTRODUCTION

Okra as vegetables are important protective foods for the maintenance of health and prevention of disease. It contains valuable food ingredients, which can be successfully utilized to build up and repair the body (Bakhru, 2003; Edet & Etim, 2007). Vegetables are valuable in maintaining alkaline reserve in the body. They are valued mainly for their high vitamin and mineral content (Bakhru, 2003). The production of vegetable has become very popular in many countries of the world due to its importance in the diet of the people. The production of vegetable has been recognized as the most affordable and accessible sources of micronutrient, which is increasingly regarded as a catalyst for rural development and as a means of increasing and generating foreign exchange in Africa (AVRDC, 2004). Okra production constitutes about 4.6 percent of the total staple food production in Nigeria in the year 1970 – 2003 (CBN, 2004).The production of Okra in Nigeria ranged from 630,000 tonnes/hectare to 730,000 tonnes/hectare between 1993-2006 (FAOSTAT, 2009). Okra is the most important fruit vegetable crop and a

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source of calorie (4550 Kcal/kg) for human consumption. It ranks first before other vegetable crops (Babatunde, Omotesho & Sholotan, 2007). It is one of the most commonly grown vegetable crops in the tropics. Okra cultivation and production has been widely practiced because of its importance to the economy and development and can be found in almost every market in Africa.

Okra is grown on a wide range of soils, provided the internal soil drainage is good. Soils high in organic matter are preferred. The addition of lime or dolomite may be necessary during soil preparation to bring the pH to about 6.0 to 6.5. However, Okra is known not to grow in water logged soils but in soils that are well drained and rich in manure. Okra grows in well drained soil with a range of pH of 6.0 to 6.5 to neutral. Addition of lime further reduces the pH. However, the addition of substances such as kerosene, petrol and lime is expected to alter its component nutrients and produce varying effects. These effects on Okra growth may be more preferable and beneficial to farmers. The basic growth pattern in annuals such as Okra is characterized by three main phases of growth; (i) establishment and seedling growth stage (ii) period of rapid growth, stem elongation and flowering as well as (iii) the ripening and senescence stage. (Harper, 1988). The sigmoid shape curve is produced by the normal growth pattern. However, soil amendments may generate variations in growth pattern. Hence the present study ascertains the comparative effects of untreated soil and soil treated with lime on the growth performance of Okra.

MATERIALS AND METHODS

Field studies were carried out in the Teaching and Research Farm in the School of Agriculture of the Delta State Polytechnic Ozoro during the 2014 rainy season. Ozoro lies at Latitude 05^{o} 30^{o}N and Longitude 06^{o} 28^{o}E in the tropical rainforest belt and it is usually characterized by a rainfall period ranging from March to November. The mean annual rainfall ranges from 2220mm to 2500mm. The rainfall distribution is such that the peak is encountered in the month of June and July. The mean annual temperature is 22^{o}C with 32^{o}C as maximum. The area is characterized by level ground with sandy loam soil and the previous cropping system has been mixed.

Pre-planting operations, Land Preparation and Planting

A Soil test was carried out to ascertain the components of the untreated soil and the soil treated with lime to ascertain their components in the Soil Science Laboratory of the Delta State University, Asaba Campus. The results are as shown in Tables 6 and 7.

The untreated soil was collected and placed in a sack. The sack containing one head pan of untreated soil alone was regarded as control. On the other hand, 1ml of lime was thoroughly mixed with one headpan of soil and placed in another sack. Subsequently, three (3) Okra seeds were planted per hole in each of the untreated and treated soil at a depth of 2.5cm in the nursery. The Okra seeds were allowed to grow into a seedling up to the 3 leave stage after which the seedlings were transplanted to the field. The field was prepared before transplanting by clearing, packing all the debris and tilling the soil. The experimental area consisted of 4 plots, with each measuring 1.8m x 2.4m, while the treatments were made up of two different soil media i.e. untreated soil and soil treated with lime. The treatments were replicated two times, fitted into Randomized Complete Block Design. The Okra variety Ladyfinger used was procured from Natural Institute of Horticultural Research (NIHORT), Ibadan. The plots were kept weed free by manually weeding the area at every two week interval without any application of pesticides and fertilizer or manure.

Data Collection and Analysis

Data on germination time and percentage was collected in the nursery with regards to days after planting. Starting from the second week after transplanting for a period of 12 weeks, data on plant height, leaf area, number of leaves and fruiting emergence was collected.

The data were then subjected to analysis using t-test statistics at 5% level of significance.

RESULTS AND DISCUSSION

Table 1 shows effect of soil media on germination time and percentage. The soil media comprising soil and lime had 100% germination within 2 days after planting, while the untreated (control) had 80% germination within 3 days after planting.

* Planting Date 10th June 2014
* Germination Date (Soil + Lime), 12th June, 2014
* Germination Date (Control), 13th June, 2014.

The data implies that the germination time for Okra seeds grown in soil media treated with lime is quicker. Two propositions in this regard are that the presence of lime in the soil may promote easy disintegration of the seed coat and enhance greater imbibition of water for faster seed germination.

Effect of soil media on plant height are shown in Table 2. Data obtained shows that the soil media treated with lime recorded Okra seedling height variations of 10.40cm, 2 WATP, 11.70cm 4WATP, 22.30cm 6WATP, 35.10cm 8WATP, 36.00cm 10WATP and 37.20cm 12WATP. An average height of 25.45cm over the period for soil media

Table 1. Effect of Soil Media on Germination Time and Percentage

Soil Media	Germination Time (days)	Germination Percentage
Soil + Lime	2	100.00
Control	3	80.00

Source: Field Data, 2014.

Table 2. Soil Media and Plant Height

Treatment	2WATP	4 WATP	6 WATP	8 WATP	10 WATP	12 WATP	Average
Soil + Lime	10.40cm	11.70cm	22.30cm	35.10cm	36.00cm	37.20cm	25.45cm
Control	8.04cm	9.00cm	9.50cm	18.20cm	19.20cm	22.20cm	14.36cm

Source: Field Data, 2014

Table 3. Soil Media and Number of Leaves

Treatment	2WATP	4 WATP	6 WATP	8 WATP	10 WATP	12 WATP	Average
Soil +Lime	5	6	8	10	12	15	9.33
Control	4	5	6	8	9	10	7

Source: Field Data, 2014

Table 4. Soil Media and Fruit Emergence

Treatment	8WATP	9WATP	10 WATP	11WATP	12WATP	Average
Soil + Lime	2	4	7	11	12	7.2
Control	1	3	5	7	11	5.4

Source: Field Data, 2014

treated with lime can be identified. On the other hand, the Okra seedlings growth in untreated soil recorded 8.04cm 2 WATP, 9.00cm 4WATP, 9.50cm 6WATP, 18.20cm 8WATP, 19.20cm 10WATP and 22.20cm 12WATP. An average height of 14.36cm over the period for soil media for untreated soil (control) can be identified. The data indicates that Okra seedlings sown in soil media treated with the lime grows to a higher height.

Table 3 reveals effect of soil media on number of leaves. The soil media treated with lime recorded 5 leaves 2 WATP, 6 leaves 4WATP, 8 leaves 6WATP, 10 leaves 8WATP, 12 leaves 10WATP and 15 leaves 12WATP. An average of 9.33 over the period for soil media with lime can be identified. On the other hand, the control recorded 4 leaves 2 WATP, 5 leaves 4WATP, 6 leaves 6WATP, 8 leaves 8WATP, 9 leaves 10WATP and 10 leaves 12WATP. An average of 7 leaves over the period for untreated soil (control) can be identified. It can therefore be stated that Okra seedlings grown in soil media treated with lime produced the greater number of leaves. This has the capability of increasing photosynthesis in plants thereby guaranteeing greater yield from the plants.

Table 4 showed effect of soil media on fruit emergence. The soil media treated with lime and that of control started recording fruit emergence at 8WATP. Specifically, the soil treated with lime recorded 2 fruits 8WATP, 4 fruits 9WATP, 7 fruits 10WATP, 11 fruits 11WATP and 12 fruits 12WATP. The average number of fruits over the period was 7.2. On the other hand, the control recorded 1 fruit 8WATP, 3 fruits 9WATP, 5 fruits 10WATP, 7 fruits 11WATP and11 fruits 12 WATP. The average number of fruits over the period was 5.4. The data indicated that the Okra seedlings sown in soil media treated with lime produced greater yield of fruits. This lays credence to the fact that a relationship exists between soil components and fruit production in crops.

Table 5. Soil Media and Leaf Area

Treatment	2WATP	4 WATP	6 WATP	8 WATP	10 WATP	12 WATP	Average
Soil + Lime	11.73cm	16.47cm	17.37cm	24.67cm	26.33cm	24.4cm	20.895cm
Control	11.33cm	11.73cm	14.73cm	20.67cm	24.13cm	25.07cm	18.443cm

Source: Field Data, 2014

Table 6. Characteristics of Untreated Soil

Parameters	Measure Values
Clay	16%
Silt	10%
Fine sand	50%
Coarse sand	24%
Total sand	74%
Textural class	Loamy sand
Bulk density	1.25g/dm
Porosity	47.1%
MWDD	1.203
MWDW	0.816
Ph(H20)	5.6
Pf (KCL)	4.1
Carbon	0.64%
Organic matter	1.10%
Nitrogen	0.24%
Sodium	0.05meg/100g
Potassium	0.03meg/100g
Calcium	0.50meg/100g
Magnesium	0.59meg/100g
ACBC	5.2meg/100g
BCES	4.8meg/100g
B.Sat	25%
Phosphorous	3.5%
Aluminum	2.8%
Hydrogen	0.8%
Exchangeable acidity	3.6%

MWDD= Mean Weight Diameter Dry, MMDW = Mean Weight
Source: Laboratory Test, 2014

Table 7. Characteristics of Lime treated soil

Parameters	Measure Values
Clay	16%
Silt	10%
Fine sand	50%
Coarse sand	24%
Total sand	74%
Textural class	Loamy sand
Bulk density	1.25g/dm
Porosity	47.1%
MWDD	1.203
MWDW	0.816
Ph(H20)	4.6
Pf (KCL)	4.0
Carbon	0.64%
Organic matter	1.10%
Nitrogen	0.24%
Sodium	0.05meg/100g
Potassium	0.03meg/100g
Calcium	0.50meg/100g
Magnesium	0.59meg/100g
ACBC	5.2meg/100g
BCES	4.8meg/100g
B.Sat	25%
Phosphorous	3.5%
Aluminum	2.8%
Hydrogen	0.8%
Exchangeable acidity	3.5 %

MWDD= Mean Weight Diameter Dry, MMDW = Mean Weight
Source: Laboratory Test, 2014

Table 8. Comparative Analysis of Growth Parameters of Okra Seedling in Lime Treated and Untreated Soils

Parameter	Sample A		Sample B		S^2	$S\bar{x}$	t_{cal}	t_{tab}	Decision
	N	$\bar{x}$	N	$\bar{x}$					
Plant height	6	25.34	6	14.36	506.90	13	0.84	0.700	Significant
Number of leaves	6	9.33	6	7.00	76.33	5.04	0.46	0.700	N. Significant
Fruit Emergence	6	7.20	6	5.40	3.90	4.643	0.39	0.700	N. Significant
Leaf area	6	20.86	6	18.443	42.73	3.77	0.64	0.700	N. Significant

P>0.05.
**Sample A – Lime treated soil containing seedlings*
**Sample A – Untreated soil containing seedlings(control)*

Table 5 indicates effect of soil media on leaf area. The soil media treated with lime recorded 11.73cm 2WATP, 16.47cm 4WATP, 17.37cm 6WATP, 24.67cm 6WATP, 26.33cm 10WATP and 29.40cm 12WATP. An average leaf area of 20.90cm over the period for soil media treated with lime can be identified. On the other hand, the control recorded 11.33cm 2WATP, 11.73cm 4WATP, 14.73cm 6WATP, 20.67cm 6WATP, 24.13cm 10WATP and

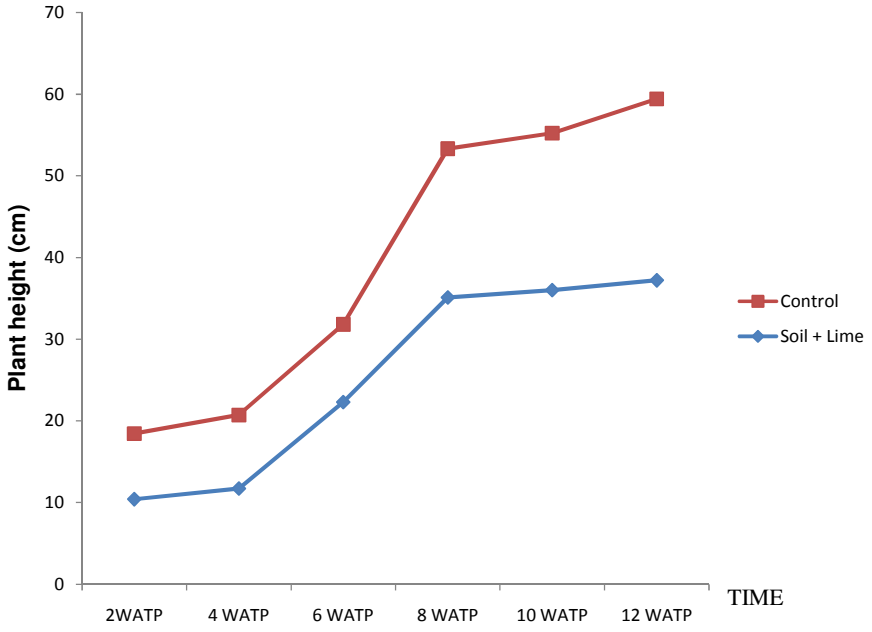

Figure 1. Growth pattern relating to plant height of okra seedlings in lime treated and untreated soils

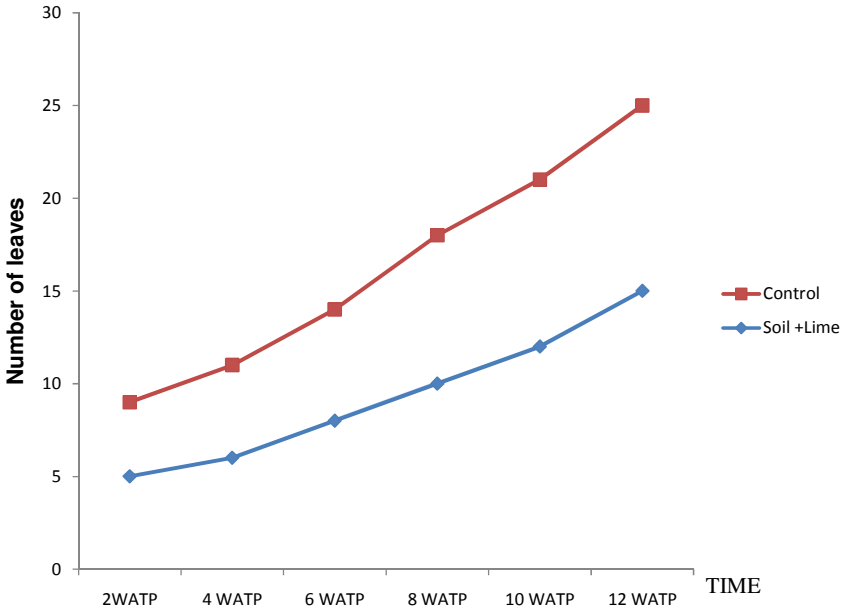

Figure II. Growth pattern relating to number of leaves of okra seedlings on lime treated and untreated soils

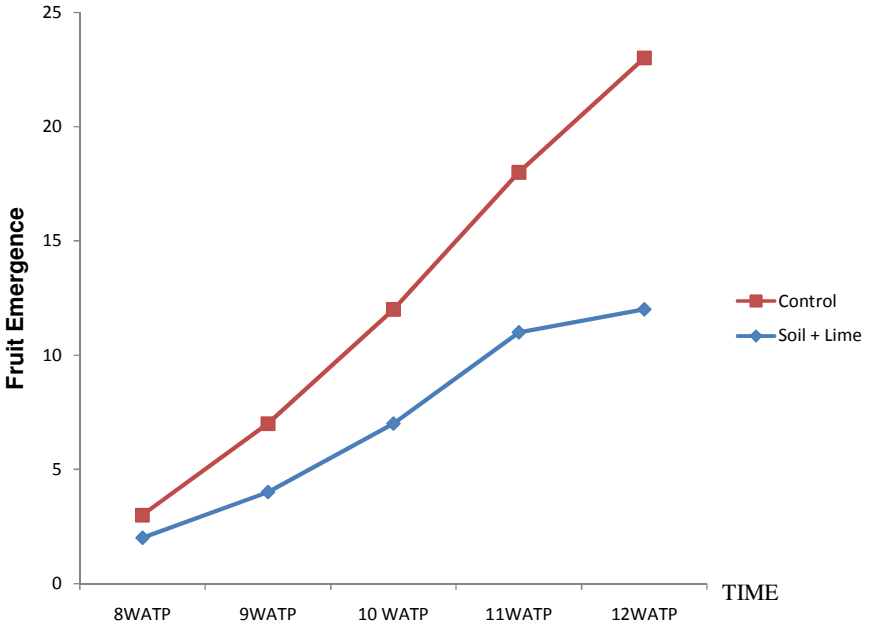

Figure III. Growth pattern relating to fruit emergence of okra seedlings in lime treated and untreated soils

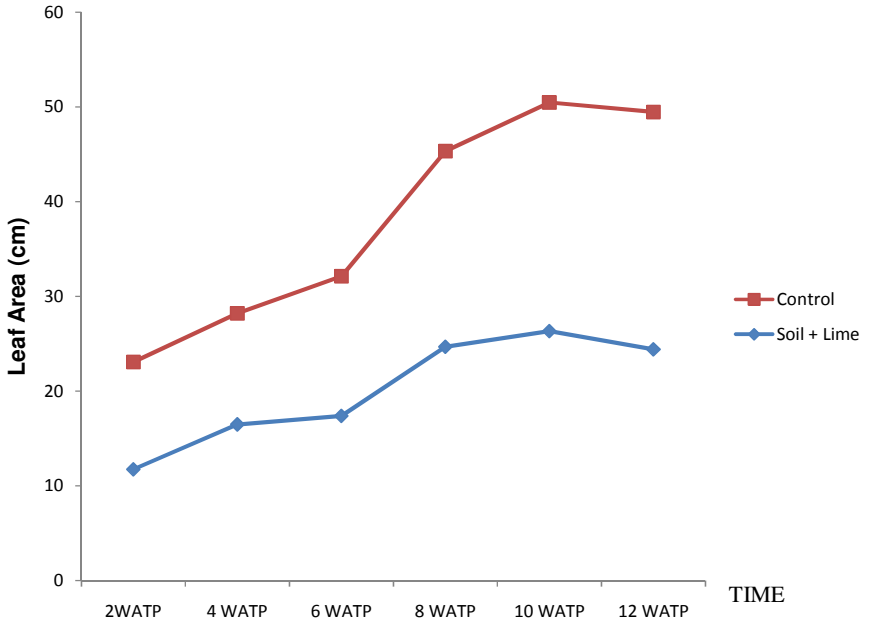

Figure IV. Growth pattern relating to leaf area of okra seedlings in lime treated and untreated soils

25.07cm 12WATP. An average leaf area of 18.44cm over the period for control can be identified. It can therefore be stated that the Okra seedlings grown in soil media treated with lime produced a higher leaf area. The plants growing in the lime treated soil that produce a larger leaf area have a larger photosynthetic area capable of greater food production.

Furthermore, the growth pattern of okra seedlings as indicated in Figure 1-IV indicate the sigmoid shaped growth curve for annual plants. For all the parameters measured,

those for the lime treated soil exhibited a better growth as compared to the untreated soil.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of this study it can be concluded that the soil media treated with lime enhanced growth of Okra more than the untreated soil. However, there were significant differences between the plant heights of okra seedlings grown in the two soil media while there were no significant differences in the number of leaves, fruit emergence and leaf area of Okra seedlings grown in the two soil media. Based on the findings of the study, the following recommendations are made;

(1) Farmers cultivating Okra should as a matter of necessity be encouraged to treat the soil in which they are growing Okra with lime. As it has been found that alkaline conditions promote the effective growth of Okra and enhance yield thus the cultivation of Okra using soil treated with lime is more preferable to that of untreated (control).

(2) The viability of Okra seeds should be tested using pre-germination tests to avoid using unhealthy seeds in the appropriate media that may not stimulate the germination of the seeds.

(3) Improved varieties of Okra seeds should be introduced and used by farmers under soil media treated with lime to enhance the display of superior characteristics and greater yield which are the overall goals of contemporary crop production system.

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